Statement of
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submitted to
U.S. House of Representatives
Resources Subcommittee on Forests and Forest Health
Field hearing on Recovering from the Fires: Restoring and Protecting Communities, Water, Wildlife and Forests in Southern California

Lake Arrowhead, California

12/5/2003

Chairman McInnis, distinguished members of the committee, it is a privilege to have the opportunity to present my testimony to you today.

The 2003 wildfires in Southern California were tragic in respect to losses of life, their impacts communities, and how they affected the forested ecosystems in this region.

In the future, I look forward to the day when a hearing such as this can be held to discuss successes relative to wildland fire and ecosystem restoration. Certainly more work must be done in this area but it would be useful to have a forum where positive aspects of wildland fire could be presented.

I will present a discussion of wildland fire in chaparral, coastal sage scrub, and forests in the southern California region. This will include the benefits and risks associated with the different methods used to reduce fire hazards and the effectiveness of post-wildfire mitigation methods. I finish with a discussion on the urban-wildland intermix.

Chaparral and Coastal Sage Scrub

Chaparral and coastal sage scrub are the vegetation types that were most affected by the 2003 southern California wildfires. Approximately 90-95 percent of the area burned was in these two shrubland vegetation types. The remaining area was in coniferous forests.

It is important to distinguish between shrublands and forests in regard to the 2003 wildfires. Chaparral and coastal sage scrub are vegetation types that are adapted to high intensity crown fires at intervals of approximately 25-50 years. They produce extensive live fuel beds as they develop and almost always burn as high intensity crown fires when successfully ignited. Under extreme fire weather, such as when the Santa Ana winds occur, the resulting fire behavior is phenomenal with flame lengths over 75 feet and rates of spread greater than 6 feet/second. This type of fire behavior is not uncharacteristic or uncommon, it is simply how these vegetation types burn under extreme weather conditions. After such fires, native vegetation will recover relatively quickly by resprouting and from the germination of a soil stored seed bank. I have conducted 22 research chaparral prescribed fires in northern California since 1995 and the vegetation in the areas burned 7-8 years ago is approximately one-half to two-thirds of what it was before burning. These ecosystems can respond quickly after high severity wildfires.

After wildfire, there is a real management concern concerning erosion impacts. Erosion is a natural part of this ecosystem, just as fire is. Immediately after fire, dry ravel erosion increases greatly as surface barriers to soil movement are removed. Dry ravel moves downslope under gravity and fills in stream channels. Early post-fire rains can promote on-slope rill networks, enabling large amounts of water and soil to move rapidly off of steep burned slopes.

Erosion tends to be high for the first few years after fire, and then gradually decreased with time, normally returning to prefire levels in 5-10 years as the increases in plant cover and root biomass help stabilize surface material.

In response to the need to protect downstream structures and resources after fire, managers began to explore ways of establishing rapid vegetation cover on burned hill slopes. Starting in the 1930's, Los Angeles county foresters first tried to seed native shrubs, then later experimented with herbaceous species such as mustards and grasses. By the 1940's, managers were routinely using annual ryegrass (Lolium multiforum) in an attempt to stabilize slopes after fire.

Evaluation of seeding effectiveness was based primarily on the level of grass cover established, with little attention given to any effects on native vegetation recovery. At this time, little or no attempts to quantify the success of this practice at reducing erosion were attempted.

Questions about the impact of seeding with annual grasses on natural vegetation recovery in chaparral and coastal sage scrub have been raised for years. Some research has observed a negative relationship between ryegrass cover and native herb cover. Lower species richness has been reported for ryegrass seeded plots. Reseeding of non-native species after fire in chaparral does not affect the long term, post-fire recovery of native shrubs.

Seeding also has the potential to increase fire frequency in chaparral and coastal sage scrub as flammable, exotic grasses provide a continuous fuel structure in a very short time period. If these systems burn frequently, a vegetation type conversion from shrublans to grasslands can occur and this can further exacerbate erosion problems because grasses provide little soil stabilization on steep slopes.

The most likely scenario for maximum effectiveness of post-fire seeding at reducing erosion would be one where rainfall is of low intensity and regularly spaced in the fall and early winter, allowing good grass cover to establish before heavy rains. However, this weather pattern does not appear to be a reliable or frequently occurring scenario on southern California chaparral sites.

In years of even moderately favorable weather conditions, seeded grasses appear to compete with the natural post-fire herbaceous flora rather than enhancing total plant cover. This competition decreases both species richness and percent cover of the native, herbaceous species. Research on the long-term effects of reseeding on the chaparral seedbanks continues but it seems seed banks are also affected by introduced annuals.

New methods to reduce erosion such as aerial straw mulching, polyacrylamide, and aerial mulching have never been rigorously field tested. The lack of information argues for a standardized program of treatment effectiveness monitoring, as pointed out in a recent General Accounting Office report on this subject.

Today, even though the best scientific information on the effects of post-fire seeding of exotic grasses tells us there are few or no positive affects, some agencies continue to promote the practice in southern California. This is slowly changing.

I believe federal and state managers should focus chaparral fuel treatments in the urban-wildland intermix. These treatments have been proven to be effective during wildfires in southern California. An example is the 1995 West Ridge prescribed fire in the San Bernardino National Forest. This chaparral prescribed fire was done below the town of Idyllwild. Two years later, the Bee wildfire burned uphill towards Idyllwild and was successfully suppressed because of the impacts of the previous burning.

Mixed Conifer, Ponderosa and Jeffrey Pine Forests

The ponderosa pine, mixed conifer, and Jeffrey pine forests that burned in 2003 are not adapted to large, high intensity fires. Most of these forests area denser and more spatially uniform, have many more small trees and fewer large trees, and have much greater quantities of surface fuels than did their presettlement counterparts. Causes include fire suppression, past livestock grazing and timber harvests, and possibly changes in climate. The results include a general deterioration in forest ecosystem integrity and an increased probability of large, high severity wildfires. Such conditions are prevalent nationally, especially in forests that once experienced short-interval (< 15 years), low to moderate-severity fire regimes.

The tree mortality that occurred in many forested areas prior to the southern California wildfires is extraordinary. I visited this region several times before the 2003 fires and in some areas, the mortality was the most severe that I have ever witnessed. The mortality is the result of several factors including past management activities that allowed more trees to become established over the last 100 years, a multi-year drought, stress from smog that is transported to this areas from the Los Angeles basin, and the impacts of native bark beetles. Past management actions set the stage for a dramatic change in this forested ecosystem. I should note that the past drought has been severe and trees have died at the lower forestshrub ecotone and this has not been witnessed in the last 70-100 years. Still, droughts are part of the natural ecosystem stresses that have and will continue to affect California. I think one of the central messages that should be learned from the forests of southern California is an active management philosophy is needed in these forested ecosystems.

Before beginning my discussion of the different methods that can be used to reduce fire hazards in these forests, I want to spend a moment on what I believe is the critical issue, the definition of desired future conditions for our diverse ecosystems. Once this is done we can then decide what management tools are appropriate to achieve and maintain the desired conditions. I believe the debate on whether we should use silviculture to manage our national forests is unproductive, the real issue is the definition of desired future conditions and how are we going to get there, and once there, how they will be maintained.

When discussing fuel hazards in coniferous forests we must examine four different fuel systems:

1) Ground fuels (leaf litter and decomposed organic materials on the soil surface)
2) Surface fuels (dead and down woody materials, herbaceous fuels, live shrubs)
3) Ladder fuels (small trees and shrubs that can provide vertical continuity to move a fire into tree crowns)
4) Crown fuels (vertical and horizontal distribution of tree crowns)

Each area of the country is unique but in most forest types that historically had frequent, low-moderate intensity fire regimes, such as most of those in the mountains of southern California, the most critical fuel complex from a fire hazard standpoint is the surface fuels, followed by the ladder fuels, and then the crown fuels. Ground fuels are relatively compact (low surface area to volume ratio) and contribute little to flaming combustion or fireline intensity.

If one is designing a fuels treatment strategy it must focus on surface fuels. Commercial and pre-commercial thinning operations can reduce ladder fuels and crown fuels but without combining these treatments with surface fuel reductions, the overall program will not reduce potential fire behavior. In fact, operations that lop and scatter the slash fuels produced after thinning operations will increase fire hazards for a decade or more until decomposition reduces fuel loads. Mechanical removal of ladder and crown fuels will reduce the probability of crown fires in an area but if surface fuels are not reduced, a high severity surface fire can be produced and it will kill the majority of the remaining trees by scorching (production of lethal thermal injuries to all exposed leaf and meristem tissues). Only when these treatments are coupled with a surface fuel treatment will this result in a reduction in potential fire behavior. One of the most effective surface fuel treatments is prescribed burning which can be used with or without prior mechanical treatments to produce the overall objective. A limitation of mechanical treatments is the need of road networks which are not available in all areas, especially in the mountains of southern California. Whatever treatment is selected, it must target the surface fuel layer, followed by ladder fuels, and then the crown fuels. Surface fuel reduction cannot be an afterthought of fuel treatments in these forests, it must be the central objective.

One of the great challenges of producing a fire hazard reduction program for the forests in southern California is the lack of infrastructure in this area. The closest sawmill to this area is in the southern Sierra Nevada. This is outside the economic range of most materials that should be removed to reduce fire hazards in this region. Presently, the National Forests in this area are chipping dead trees on site and dispersing the chips locally over the forest floor. This is an improvement in terms of fire hazard reduction but it is a very slow, expensive alternative. The large chipper that worked in the forest around Lake Arrowhead this summer cost $580/hour to operate. In addition to this machine and its operator, tree fallers and skidder operators were needed to move the dead materials to the large chipper. I watched this machine operate this summer and it could only chip approximately 1-2 acres per day in areas where tree mortality was heavy. There is a real need to have a local mill in this region that could efficiently process materials removed to improve forest health.

Another critical question is the definition of desired future conditions for the forests in this region. One forested ecosystem exists that can be compared to those found in southern California, this is the Sierra San Pedro Martir (SSPM) in northwestern Mexico. This forest is composed of mixed conifer forests and shrublands of the Californian floristic province that occur nowhere else in Mexico. The SSPM is unique within the California floristic province in that its forests were never harvested and a policy of large-scale fire suppression did not begin until 1970. I have been conducting research in this area since 1998 and it can provide information that can assist in the production of desired future conditions in the forests of southern California. There is a great amount of spatial heterogeneity in the forests of the SSPM. Average surface fuel loads are small (6 tons/acre). Over the last 4 years, the forests of the SSPM have experienced a similar drought to that experienced in the forests of southern California. I have a set of forest inventory plots in this region and snag density increased from 1.7/acre to 2.6/acre over the last 3 years. This is a large mortality event for this region but is orders of magnitude smaller than what occurred in southern California. One of the goals of forest management should be to produce resilient forest structures that can incorporate natural disturbances such as fire, insects, diseases, and drought without catastrophe (tree mortality outside desired conditions). Forest management plans should be flexible to allow managers enough space to propose creative field-based solutions to address our current fire problems. There is presently mistrust in many sectors of federal forest management and this has impeded the ability to allow flexibility. A vigorous system of adaptive management at large spatial scales would reduce these barriers.

California has huge challenges to overcome in terms of wildland fire. The state has a Mediterranean climate (dry hot summers) and almost all of its vegetation is fire adapted. The exclusion of fire and past management practices has produced ecosystems that are not sustainable. California also has the largest population in the nation and the number of people moving into the urban-wildland intermix is increasing. The USFS has been attempting to produce a plan to manage the National Forests of the Sierra Nevada since 1990 and wildland fire has been one of the central issues. After 13 years of debate, we still don't have a final plan. The ecosystems in southern and northeastern California have similar management challenges.

Since fire hazard reduction has never been the main objective of USFS land management, we have no large-scale research to support such a management philosophy. There simply are no places to go in California to get information on the trade-offs (economic, social, ecological) of large-scale management treatments designed to reduce fire hazards and improve forest health. I have become aware of a new bill in Congress, H.R. 2696 (Fire Institute Bill) that attempts to fill this need. It proposes 3 new Fire Institutes that would "promote the use of adaptive ecosystem management to reduce the risk of wildfires and improve forest health." The new institutes would be funded for 5 years and would be created with the consultation of the Secretary of Agriculture. I fully support this idea because of the real need for increased information but am distressed that California is not one of the states that would receive such an institute. There is no state in our nation that has more complex fire and forest health issues than California.

Urban-Wildland Intermix

Land management agencies throughout the country are increasingly aware of the difficulties of managing in the urban-wildland intermix. This is a very complicated landscape with homes, subdivisions, and towns all mixed into or adjoining wildland areas. The number of people who choose to live in this area continues to increase and many wildland fire agencies such as the California Department of Forestry and Fire Protection believe this is the area where their fuels treatments should be focused.

I believe this area requires partnerships between home owners and the public or private organizations that have responsibility for the adjoining wildlands. Strategic fuel reduction zones can be created in the urban wildland intermix to allow for more effective and safe suppression activities when wildfires are moving from the wildlands toward homes or from the homes into the wildlands.

Private home owners share responsibility in this area. Homes must be built with combustion resistant roofs and siding materials. Defensible space must be created around each structure to increase the probability that it will survive a wildfire. Fine fuels and needles must be removed annually from roofs and around houses to reduce the chance of spot fire ignition during wildfires. To reduce losses in this area, a shared partnership must occur between the private land owner and the manager of the adjoining wildlands. Currently most of the debate is focusing on what large land managers must do to reduce risk but an equal amount of responsibility rests on the private side of the intermix. Counties and states must take action to ensure that individual home owners reduce their potential for catastrophic fire.

Thank you for the opportunity to speak to you today.

Resume

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EDUCATION

Ph.D. Wildland Resource Science, University of California, Berkeley, 1995.

Graduate study, Departments of Land, Air and Water Resources and Biological and Agricultural Engineering, University of California, Davis, 1988-1991. (hydrology, soil science, plant science)

M.S. Bio-Engineering, California State University, Sacramento, 1988.

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RESEARCH PROJECT ABSTRACTS

Fire and Fire Surrogate Treatments for Ecological Restoration. 2000-present. Stephens, and other UC faculty. Current coniferous forests in California and other parts of the nation are denser and more spatially uniform, have many more small trees and fewer large trees, and have much greater quantities of forest fuels than did their presettlement counterparts. The results include a general deterioration in forest health and sustainability, and an increased probability of large, high-severity wildfires. The need for large increases in the use of restorative management practices is clear. Less clear, however, is the appropriate balance among silvicultural cuttings, mechanical fuel treatments, and prescribed fire. What components or processes are changed or lost, and with what effects, if fire "surrogates" such as cuttings and mechanical fuel treatments are used instead of fire, or in combination with fire? This is area that this research project is concentrating on by installing and monitoring a national network of fire and fire “surrogate” experiments at relatively small spatial scales (25-40 acre treatment units). States included in the network include California, Oregon, Washington, New Mexico, Arizona, Montana, South Carolina, Ohio, North Carolina, Alabama, and Florida. Stephens is the principal investigator on the Sierra Nevada research site located at the University of California Blodgett Research Forest.

Ecological Effects of Fire and Silviculture Treatments in the Stanislaus National Forest. 2000-present. Leda Kobziar (graduate student), Stephens, O’Hara. Pine plantation establishment is common throughout the nation, as the most effective means of reforestation after wildfire. Plantations cover nearly 400,000 acres in the Modoc, Lassen, Plumas, Tahoe, El Dorado, Stanislaus, Inyo, Sierra and Sequoia National Forests. Very high fire hazards are present in and around many of these plantations, due to a high success rate in tree reestablishment and dense post-fire brush growth, low summer fuel moisture content, and steep, mountainous terrain. This study will contrast the effects of 5 different methods in mitigating fire hazards including 1) cut to length harvesting-slash and existing fuels crushed and left on site, 2) whole tree harvesting-whole trees removed to landing and biomassed, existing fuels crushed and left on site, 3) mastication of trees and shrubs, slash and existing fuels left on site, 4) cut to length harvesting followed by prescribed fire, 5) whole tree harvesting followed by prescribed fire, and 6) control. In achieving the primary objective, several secondary objectives will be addressed including the effect of the treatment on (1) fire hazard reduction, (2) vegetation response, (3) fire behavior and, (3) costs and benefits.

Ecological Diversity in Chaparral Following Prescribed Fire and Mastication in Varying Seasons. 2000-present. Jennifer Potts (graduate student), Stephens, and McBride. High severity wildfires are very common in chaparral. The urban-wildland intermix adds to the complexity of chaparral management because of increased ignitions from people and the potential for high losses of life and property. Prescribed fire has been the most commonly used technique for the reduction in fuel loads in chaparral. The effects of the season of prescribed fire is not understood in chaparral. Burning when soil moistures are high may have a negative impact on obligate seeding species, there is even less information on the effects of mechanical fuel treatments (mastication and chipping). The objective of this study is to contrast the efficacy of prescribed burning with mechanical methods in reducing fire hazard in chaparral. In achieving the primary objective several secondary objectives will be addressed including the effect of the season of treatment on (1) fire hazard reduction, (2) recovery of vegetation, (3) resurgence of fuels, and (4) costs of the different treatments. The experiment is being conducted at the Bureau of Land Management Cow Mountain Recreation Area and at the UC Hopland Research Station and will use a complete randomize design with replication (4 replicates for prescribed fire treatments including winter, spring, and fall burns, 3 replicates for mechanical treatments including mastication and chipping).

Fire History, Climate, and Corresponding Forest Structure in Coniferous Forests Under Unmanaged Fire Regimes, 1997-present. Stephens. One large, mixed conifer ecosystem exists in western North America where logging has never occurred and a policy of fire suppression was never initiated, this area is in the Sierra San Pedro Martir (SSPM). This forest is composed of mixed conifer forests and shrublands of the Californian floristic province that occur nowhere else in Mexico. The SSPM is unique within the California floristic province in that its open forests are still influenced by lightning ignited fires. This research project has collected quantitative information on fire history and what types of forest structures (live tree densities, fuel loads, snag densities) that exist in a mixed conifer forest that has a disturbance regime which has not been effected by management, with the exception of livestock grazing. Regeneration patterns (clumped, random, uniform) are being investigated using spatial statistics in a 4 ha. area that has been stem mapped and each tree above 5 cm DBH bored. Regeneration occurrence is also being investigated to determine if climate and/or fire occurrence is correlated with establishment.

The Eastern Sierra Nevada and the Sierra San Pedro de Martir, 2002-present. Stephens. High severity wildfires are common in pine forests of the western United States. Many have suggested this is primarily due to changes in stand structures and composition from past logging and systematic fire suppression of the last century. There is currently debate on appropriate target conditions for fire hazard reduction and forest restoration. This is due to the lack of unmanaged forests that could serve as references in the western US. The pine-dominated, mixed conifer forests of the Sierra San Pedro Martir (SSPM), Mexico, have not experienced logging and systematic fire suppression. The SSPM is unique within the California floristic province in that its forests are still regularly influenced by fires similar to those that once occurred throughout the western United States. The mixed conifer forests of the SSPM may provide information on reference conditions for forests that prehistorically experienced frequent, low to moderate intensity fires. This information could be used to help develop target stand conditions for reducing the fire hazard in large portions of California and Nevada mixed conifer forests. The objectives of this project are to compare climate, fire history, and stand structures of coniferous forests of the Sierra San Pedro Martir with similar forests of the eastern Sierra Nevada.

Landscape Scale Effects of Prescribed Natural Fire Programs in Three Wilderness Areas, 2002-present. Moody (graduate student), Stephens. In the early 1970's, the National Park Service and the Forest Service introduced the Prescribed Natural Fire (PNF) program [now called the Wildland Fire Use (WFU) Program] in several wilderness areas, in efforts to restore fire as a natural ecosystem process. The Sugarloaf-Roaring River region of the Sequoia-Kings Canyon National Park, the Illouette Creek Basin in Yosemite, and the Gila Wilderness in New Mexico were among the first areas in which naturally ignited fires have been allowed to burn under prescribed conditions, as long as they do not threaten life or property. Synthesis of ground and GIS analyses will help determine how WFU policies have affected forest processes and resiliency. This may lend information to today's debates about roadless area management and ecosystem restoration.

Fire History and Climate of the Transverse and Peninsular Ranges of Southern California, 2002-present. Stephens, Everett, Skinner. The USFS recently released the Southern California Mountains and Foothill Assessment for the Cleveland, San Bernardino, Angeles, and Los Padres National Forests. This assessment identified fire management as one of its important goals but only one published fire history study is available to assist in plan development. The single fire history study did not use cross-dating and had a very limited spatial extent. Information on past fire season was not obtained. Lack of comprehensive information makes it extremely difficult to understand past fire dynamics in this large, diverse area. The objective of this project is to collect, cross-date, and analyze fire history information from the Cleveland, San Bernardino, Angeles, and Los Padres National Forests in southern California. The interaction of climate and past fires will also be examined. The 2003 wildfires have added to the importance of understanding the historic role of fire in this region.

PROFESSIONAL SOCIETY MEMBERSHIPS
Association for Fire Ecology – Vice President Elect
International Association of Wildland Fire
Society of American Foresters

Selected Peer Reviewed Publications

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Stephens, S.L., and B. M. Collins. 2004. Fire regimes of mixed conifer forests in the north-central Sierra Nevada at multiple spatial scales. Northwest Science (in press).
Stephens S.L., C.N. Skinner, and S.J. Gill, 2003. Dendrochronology-based fire history of Jeffrey pine-mixed conifer forests in the Sierra San Pedro Martir, Mexico. Canadian Journal of Forest Research 33:1090-1101.
Stephens, S.L., and M.A. Finney, 2002. Prescribed Fire Mortality of Sierra Nevada Mixed Conifer Tree Species: Effects of Crown Damage and Forest Floor Combustion. Forest Ecology and Management 162: 265-275.
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Stephens, S.L., Molina D.M., Carter, R., Martin, R.E. 1994. Comparison of fuel load, structural characteristics, and infrastructure before and after the Oakland Hills Tunnel fire. Biswell Symposium, USDA PSW General Technical Report-158 . pp.189-191.

Follow-Up Address

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